Webinar:
LFG Wellfield Operational Considerations for Pipeline Quality Gas or Vehicle Fuel Projects

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Presenter:
Frank Terry, Project Manager, Smith Gardner, Inc.,
(contractor to U.S. EPA LMOP)
Topics

• Background

• Collection System Design and Construction for High-Btu Wellfields

• High-Btu Wellfield Monitoring and Tuning
Background
### Background: Low vs. High-Btu projects

<table>
<thead>
<tr>
<th></th>
<th>Low- and Medium-Btu</th>
<th>High-Btu</th>
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<tbody>
<tr>
<td><strong>Heat Content</strong></td>
<td>350-550</td>
<td>950-1,000</td>
</tr>
<tr>
<td>(British thermal unit</td>
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<td></td>
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<tr>
<td>per standard cubic</td>
<td></td>
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<td>foot, Btu/scf)</td>
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<tr>
<td><strong>Uses</strong></td>
<td>Boilers, engines,</td>
<td>Pipeline injection, vehicle</td>
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<td></td>
<td>microturbines,</td>
<td>fuel (Compressed Natural</td>
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<tr>
<td></td>
<td>turbines, kilns,</td>
<td>Gas ([CNG], Liquefied</td>
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<tr>
<td></td>
<td>combined heat and</td>
<td>Natural Gas [LNG])</td>
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<tr>
<td></td>
<td>power, greenhouses,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and other</td>
<td></td>
</tr>
<tr>
<td></td>
<td>manufacturing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>processes that</td>
<td></td>
</tr>
<tr>
<td></td>
<td>require fuel</td>
<td></td>
</tr>
<tr>
<td><strong>Number of</strong></td>
<td>483 – electricity</td>
<td>38 – pipeline injection</td>
</tr>
<tr>
<td><strong>Operational</strong></td>
<td>121 – non-Electricity</td>
<td>5 onsite CNG</td>
</tr>
<tr>
<td><strong>Projects</strong></td>
<td></td>
<td>1 onsite LNG</td>
</tr>
<tr>
<td><strong>First Project</strong></td>
<td>1975 (Palos Verdes,</td>
<td>1982 (Fresh Kills, NY)</td>
</tr>
<tr>
<td><strong>Installation</strong></td>
<td>CA)</td>
<td></td>
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<tr>
<td><strong>Gas Treatment</strong></td>
<td>Moisture and</td>
<td>Moisture, contaminant</td>
</tr>
<tr>
<td></td>
<td>contaminant removal</td>
<td>and CO₂ removal</td>
</tr>
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<td>(as needed)</td>
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Collection System Design and Construction for High-Btu Wellfields
Typical Gas Collection System Components

- Vertical Wells
- Horizontal Collectors
- Leachate Riser Tie-ins
- Header and Lateral Piping
- Piping Components
Vertical Wells

• Low impact on landfill operations during construction

• Proven performance and lifespan

• Can be tailored to optimize high-Btu production via:
  ▪ Increased well density
  ▪ Bore depth
  ▪ Solid casing depth
  ▪ Location
  ▪ Bore seal integrity and placement
  ▪ Well boots
Horizontal Collectors

• Inexpensive construction: no specialized equipment

• Effective in supplementing production but also subject to poor reliability, shorter lifespan and intermittent performance due to:
  ▪ Liquid blockage
  ▪ Differential settlement
  ▪ Pipe collapse or pinching
  ▪ Premature use
Leachate Riser Tie-ins

• Usually can be easily connected to the GCCS

• Typically high flow rates, but notorious for oxygen leaks

• Effective in supplementing production, but also subject to poor reliability and intermittent performance due to:
  - High leachate levels
  - Pump failure
  - Transducer malfunction
Lateral and Header Piping

• Construction quality matters
  ▪ Leaks may not be noticeable immediately after installation
  ▪ Poor construction technique will eventually be revealed under high-Btu extraction conditions

• High Density Polyethylene (HDPE) piping is preferred over polyvinyl chloride (PVC)
  ▪ Joining and fittings preferences, where possible:
    ▪ Butt fusion joining is preferred over electrofusion
    ▪ Molded fittings preferred over fabricated fittings
Other Piping Components

- Control Valves: More is better
  - Sample Port Risers: Placement for easy access
  - Condensate traps, sumps, and pump stations
    - Minimize penetrations
    - Utilize flanged or threaded connections wherever possible in place of rubber slip couplings
Typical problematic areas for potential air leaks

- Sumps
- Wellheads
Pipe fitting selection for High-BTU wellfield applications

Molded Fitting

Fabricated Fitting
Minimizing potential air leaks during construction

Fabricated fittings will be under stress from differential settlement
High-Btu Wellfield Monitoring and Tuning
High-Btu Wellfield Tuning Considerations

- LFG Generation
- Monitoring Objectives
- Analyzers
LFG Generation

- Four Phases of LFG Generation

Source: EPA 1997
Inlet Gas Quality: Medium-Btu vs. High-Btu

Medium BTU:
- Nitrogen: 10.0%
- Oxygen: 2.0%
- Carbon Dioxide: 38.0%
- Methane: 50.0%

High BTU:
- Nitrogen: 2.0%
- Oxygen: 0.5%
- Carbon Dioxide: 42.5%
- Methane: 55.0%
Monitoring Objectives

• Define and understand production goals and compliance requirements
  ▪ Monthly NSPS minimum for compliance
  ▪ Bi-monthly recommended for production

• Define and categorize collection zones
  ▪ Identify problematic or sensitive areas

• Determine baseline tuning frequency to maintain consistency
  ▪ Increase monitoring focus where necessary

• Establish call out schedules and troubleshooting procedures to minimize downtime
Options: LFG Analyzers

Landtec GEM 5000

Elkins Envision
Options: Analyzers

Agilent Micro GC 3000
# Summary: LFG Analyzers

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<tr>
<th></th>
<th>GEM 5000</th>
<th>Envision</th>
<th>Agilent Micro GC</th>
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<tbody>
<tr>
<td>Gases Measured</td>
<td>CH$_4$, CO$_2$, O$_2$, CO, H$_2$S</td>
<td>CH$_4$, CO$_2$, O$_2$</td>
<td>CH$_4$, CO$_2$, O$_2$, H$_2$, H$_2$S</td>
</tr>
<tr>
<td>CH$_4$ Accuracy</td>
<td>+/-&lt; 0.5%</td>
<td>+/-&lt; 2%</td>
<td>10ppm</td>
</tr>
<tr>
<td>O$_2$ Accuracy</td>
<td>+/-&lt; 1%</td>
<td>+/-&lt; 2%</td>
<td>10ppm</td>
</tr>
<tr>
<td>Onboard Vacuum Pump</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Internal Data Storage</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Pressure Readings</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
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Truck Mounted Gas Chromatograph
Truck Mounted Gas Chromatograph: Sample Train
Thank you for participating

If you have any questions, please contact LMOP at

lmop@epa.gov or through our website at
https://www.epa.gov/lmop/forms/contact-us-about-landfill-methane-outreach-program